UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/729,756	12/05/2003	Shoupu Chen	87121SLP	3184

70523 7590 04/29/2008

Carestream Health Inc,
150 Verona Street
Rochester, NY 14608

EXAMINER	
MACKOWEY, ANTHONY M	
ART UNIT	PAPER NUMBER
2624	
MAIL DATE	DELIVERY MODE
04/29/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/729,756	CHEN ET AL.	
	Examiner	Art Unit	
	ANTHONY MACKOWEY	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 April 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-9 and 11-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-9 and 11-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on April 7, 2008 has been entered.

Response to Arguments

As to applicant's arguments regarding the newly amended limitation "a sequence of in vivo images in a same set," applicant argues the images disclosed by Wyman reference are from two separate sets. In examination the claims are given the broadest reasonable interpretation. The claims do not recite any limitations defining what a "set" is nor does the disclosure of the present invention explicitly present a definition for a "set." Therefore, a "set" of images may reasonably be construed as a group images related in some way. The Wyman reference discloses registering a sequence of MRI images to CT images or images obtained from the same imaging modality but at different times (col. 7, lines 30-60; col. 1, lines 53-65), which are related because they are of the same physical structure. Therefore Wyman discloses "a sequence of in vivo images in a same set" as required by claim 1. Regardless, Wyman further discloses the disclosed technique can be used for registering any sets of 2D or 3D images (col. 7, lines 61-64) and it is therefore obvious to one of ordinary skill in the art at the time the invention was made that the

techniques taught by Wyman could be used to align the images obtained from the encapsulated endoscope system such as the one taught by Uchiyama as the examiner had clearly articulated in the final Office action (pages 7 and 8). In this case, the individual images obtained by the encapsulated endoscope correspond to the "sets" to be aligned taught by Wyman. However, these images have all been obtained by the encapsulated endoscope in as it travels through the patient and is therefore "a sequence of in vivo images in a same set" as recited in claim 1 and described in the detailed disclosure of the present invention.

As to applicant's arguments regarding the "accumulated rotation angle," applicant submits Wyman does not teach or suggest accumulating a rotation angle and using it to correct other images in the sequence. Upon further consideration Wyman does not disclose in enough detail the registration and alignment of any additional image to sufficiently anticipate the accumulated rotation angle as recited in claim 1. However, Uchiyama clearly discloses determining an accumulated rotation angle between a reference image and one of the other images and using it to align the multiple images obtained from the encapsulated endoscope (Figs. 5 and 6; pages 3-4, paragraphs 58-73). Thus, a combination of the teachings of Wyman and Uchiyama would render the claimed invention obvious. This combination will be articulated in detail below.

Regarding arguments presented for claim 8, Wyman selects points that do not reside on the axis of the first image plane. Wyman exemplarily selects the corner points because they would have the greatest amount of movement between the two images if they are rotated with respect to one another (col. 10, line 48 – col. 11, line 3). However, in view of applicant's own specification describing the selection of feature points and determining the rotation angle based

on the movement of the points between the two images (page 12, line 26 – page 13, line 8), examiner believes the selection of the points on the axis to be an obvious design choice. The specification at page 13, lines 3-4 clearly states "people skilled in the art can easily extend this analysis to points that are not on the axis." Examiner believes a selection of points on an axis in addition to the corners of the images in invention of Wyman would not cause Wyman's technique to fail in aligning the images.

Regarding arguments presented for claim 17, the claim language does not explicitly preclude the images from spatially overlapping and therefore does not exclude the images taught by Wyman and clearly not the endoscope images taught by Uchiyama.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3-9 and 11-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wyman in view of US 2003/0229268 to Uchiyama et al. (Uchiyama).

Regarding claims 1 and 17, Wyman discloses a digital image processing method for automatic axial rotation correction of a sequence of in vivo images in a same set (col. 6, lines 34-37; col. 7, lines 30-64; col. 1, lines 53-65), comprising the steps of:

a) selecting, as a reference image, a first arbitrary in vivo image from the sequence of in vivo images (col. 6, lines 40-45);

b) determining a rotation angle between a second arbitrary in vivo image selected from the sequence of in vivo images and the reference image of the sequence (col. 6, lines 57-61; col. 8, lines 23-37; col. 9, lines 43-49; col. 10, line 48 - col. 11, line 3; col. 11, lines 41-58, *Wyman teaches applying affine transformations including rotating the images in the image registration. The Examiner believes the determination angle of a rotation angle between the reference image and the second image is inherent to the rotation transformation of registration method taught by Wyman.*);

c) correcting the orientation of the second arbitrary in vivo image, with respect to orientation of the reference image and corresponding to the rotation angle (col. 6, lines 61-64; col. 8, lines 23-37; col. 9, lines 43-49; col. 10, line 48 - col. 11, line 3; col. 11, lines 41-58).

Wyman further discloses using orientation corrected images to determine a rotation angle between other selected in vivo images and the reference image (col. 6, lines 57 – col. 7, line 3; col. 8, lines 23-37; col. 9, lines 43-49; col. 10, line 48 - col. 11, line 3; col. 11, lines 41-58; col. 9, lines 1-6, *Wyman teaches applying affine transformations including rotating the images in the image registration thereby bringing an arbitrary number of images, into alignment. Wyman further teaches the transformations may be applied to a subset, convergence is determined and the steps are repeated, thus the transformed subset (orientation corrected images) is used to perform registration of the rest of the set (other in vivo images). The Examiner believes the determination angle of a rotation angle between the reference image and the second image is inherent to the rotation transformation of registration method taught by Wyman.*); and correcting

for the other selected in vivo images that do not match the reference image's orientation and where there exists a rotation angle between the other selected in vivo images and the reference image (col. 6, lines 61-64; col. 8, lines 23-37; col. 9, lines 43-49; col. 10, line 48 - col. 11, line 3; col. 11, lines 41-58; col. 9, lines 1-6, *Wyman teaches the process may be extended to bring an arbitrary number of images or image sets into alignment.*). Wyman further discloses the disclosed technique can be used for registering any 2D or 3D images (col. 7, lines 61-64)

While Wyman discloses bringing any arbitrary number of images into alignment, the explicit details of the alignment are limited to a discussion of only two images. Therefore, Wyman is silent with regard to an accumulated rotation angle which is used to correct other selected in vivo images and the reference image. Uchiyama discloses a using orientation corrected images to determine an accumulated rotation angle between other selected in vivo images in a sequence and a reference image from a sequence of in vivo images captured by an encapsulated endoscope and correcting for the other selected in vivo images that do not match the reference image's orientation using the accumulated rotation angle where there exists a rotation angle between the other selected in vivo images and the reference image (Figs. 5 and 6; pages 3-4, paragraphs 58-73).

Wyman and Uchiyama are combinable because they are both concerned with medical image processing, specifically rotating the medical images to properly align them for display. It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the techniques taught by Wyman and Uchiyama such that the image registration techniques taught by Wyman could apply to images captured by an encapsulated endoscope system such as the one taught by Uchiyama (and the present invention) and that the method of

Wyman could be modified to include using the orientation corrected images to determine an accumulated rotation angle between other selected in vivo images the sequence and a reference image from a sequence of in vivo images captured by an encapsulated endoscope and correcting for the other selected in vivo images that do not match the reference image's orientation using the accumulated rotation angle where there exists a rotation angle between the other selected in vivo images and the reference image, as taught by Uchiyama, in order to bring any arbitrary number images into alignment with the reference image.

Regarding the limitation "where the second arbitrary image and the reference image need not have a spatially overlapping area" as recited in claim 17, the language of the claim does not explicitly preclude the images from a having spatially overlapping area, just that they don't necessarily have to. Thus the images disclosed by Wyman meet the requirements of the claim. Further Uchiyama's images are a sequence of image captured by the encapsulated endoscope and are aligned based on the accumulated rotation angle and therefore, the first image would not need not to be spatially overlapping with an arbitrary other image in the sequence.

Regarding claim 3, the combination of Wyman and Uchiyama further discloses the step of correcting the orientation of the arbitrary in vivo image, with respect to orientation of the reference image and corresponding to the rotation angle uses an accumulated correction angle derived from the accumulated rotation angle (Wyman, Fig. 5; col. 8, line 60 – col. 9, line 6; col. 10, line 48 – col. 11, line 3; Uchiyama, Figs. 5 and 6; pages 3-4, paragraphs 58-73).

Regarding claim 4, the combination of Wyman and Uchiyama further discloses the rotation angle measured with respect to an optical axis of an in vivo camera used to capture the plurality of in vivo images, and wherein the optical axis is perpendicular to an image plane and is parallel to the in vivo camera's travel trajectory derivative (Uchiyama, Figs, 3, 9, 10, 12, 13, 14, 15, 16; paragraphs 6, 42, 55-58).

Regarding claims 5 and 6, the combination of Wyman and Uchiyama further discloses the rotation angle is defined in a right-hand system or a left-hand system and angle is rotated counter-clock wise or clockwise relative to the reference image's orientation, such that the rotation angle is a signed value (Wyman, Fig. 8; Fig. 9E; col. 8, lines 1- 37; col. 11, line 41 – col. 12, line 4; col. 14, lines 60-62).

Regarding claim 7, the combination of Wyman and Uchiyama further discloses the plurality of in vivo images have a plurality of feature points, and wherein the plurality of feature points are used for finding an orientation difference between two in vivo images (Wyman, col. 6, lines 46-64).

Regarding claim 8, Wyman discloses an origin of a two-dimensional coordinate system of the in vivo images, thus defining an image plane, is at an image's center (Fig. 5; col. 10, lines 48 – col. 11, line 3, Wyman clearly shows two-dimensional images oriented in an X-Y coordinate system, with Z coordinate identifying each image's two-dimensional plane location in the stack of images, with an origin at the intersection of the intersection of axes. It is clear if the

image sets are limited to a single image (as suggested by Wyman at column 8, lines 63-65), the coordinate system would be limited to a two-dimensional system as there is no "stack" of images"), and further comprising the steps of:

a) collecting the plurality of feature points that reside on a first image plane (Fig. 5; col. 6, lines 46-54; col. 10, line 48 – col. 11, line 3, Wyman selects points at the corners of the images);

b) finding a corresponding plurality of feature points in a second image plane (col. 6, lines 46-54; col. 10, lines; col. 10, line 48 – col. 11, line 3);

c) determining whether a feature point that resides on the first image plane moves in the second image plane (col. 6, lines 54-57); and

d) measuring the feature point's movement in the second image plane to determine the rotation angle and its direction (col. 6, lines 57-64; col. 10, line 48 – col. 11, line 3).

The combination of Wyman and Uchiyama does not disclose expressly collecting the plurality of feature points that reside on the axis of a first image plane; determining whether the feature point that resides on the axis of the first image plane moves off axis in the second image plane; and measuring the feature points movement off axis in the second image plane to determine the rotation angle and its direction.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the feature points taught by Wyman to include points that reside on the axis of the image plane. Applicant has not disclosed that collecting feature a plurality of feature points that reside on an axis of an image plane provides an advantage, is used for a particular purpose or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected

Applicant's invention to perform equally well with points not on the axis because applicant's specification recites "people skilled in the art can easily extend this analysis to points that are not on the axis" (page 13, lines 3-4).

Therefore, it would have been obvious to one of ordinary skill in this art to modify the combination of Wyman and Uchiyama to include collecting a plurality of feature points that reside on an axis of a first image plane to obtain the invention as specified in claim 8.

Regarding claims 9, 11-16, the combination of Wyman and Uchiyama further discloses a computer storage medium having instructions stored therein for causing a computer to perform a method (Wyman, col. 11, lines 18-39).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANTHONY MACKOWEY whose telephone number is (571)272-7425. The examiner can normally be reached on M-F 9:00-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Bella can be reached on (571) 272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew C Bella/
Supervisory Patent Examiner, Art Unit 2624

AM
4/25/08